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Sekido

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(54) **ELECTRONIC COMPONENT MOUNTING STRUCTURE**

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H05K 1/02 (2006.01)

H05K 1/14 (2006.01)

(52) **U.S. Cl.**

CPC **H05K 1/183** (2013.01); **H05K 1/0284** (2013.01); **H05K 1/14** (2013.01); **H01L 2224/16227** (2013.01); **H01L 2924/15156** (2013.01); **H01L 2924/15157** (2013.01); **H05K 1/181** (2013.01); **H05K 2201/047** (2013.01)

(58) **Field of Classification Search**

USPC 361/760, 761; 174/260
See application file for complete search history.

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(57) **ABSTRACT**

An electronic component mounting structure includes a three-dimensional substrate having a three-dimensional shape and including a hollow portion formed on at least one of side surfaces of the three-dimensional substrate, and an electronic component mounted on a bottom face of the hollow portion. The three-dimensional substrate includes an opening portion on a side surface different from a side surface on which the hollow portion is formed for allowing observation of a connection portion between the bottom face of the hollow portion and the electronic component from an outer periphery side of the three-dimensional substrate.

16 Claims, 8 Drawing Sheets

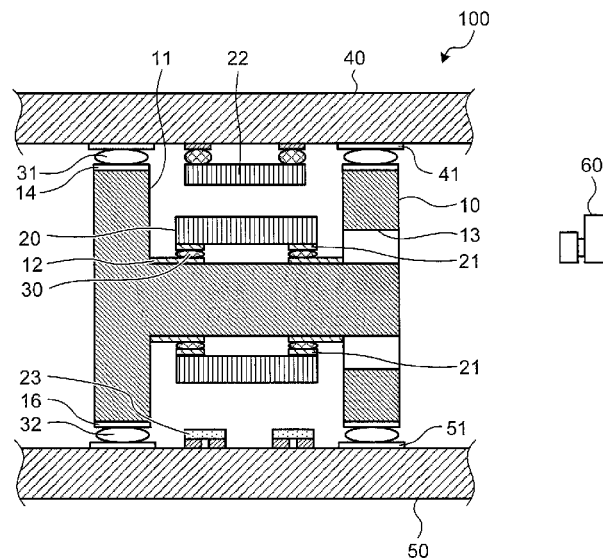
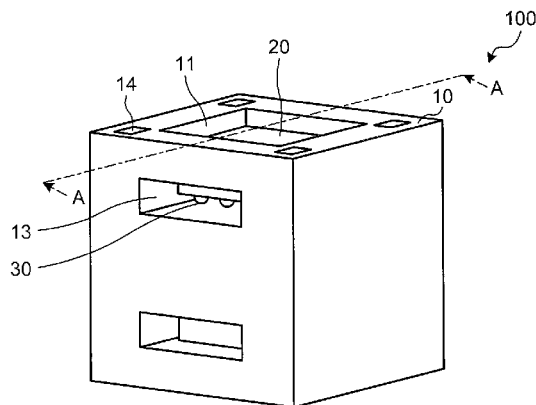


FIG.1A

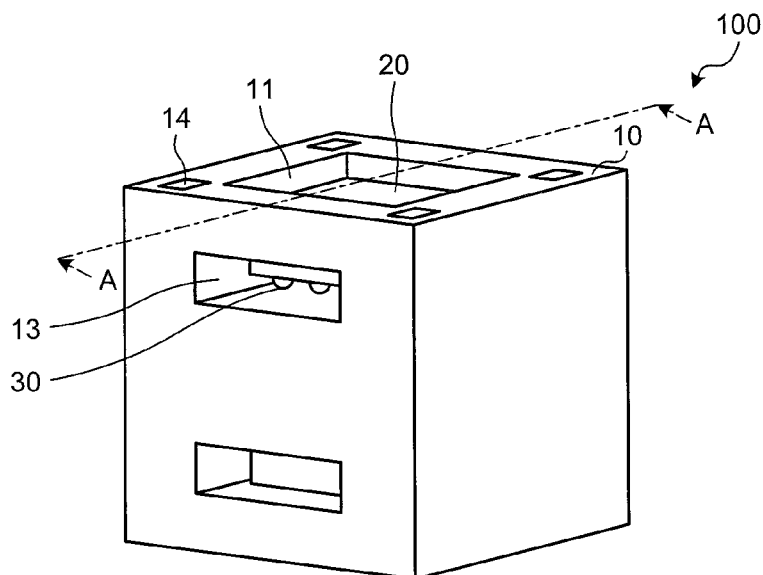


FIG.1B

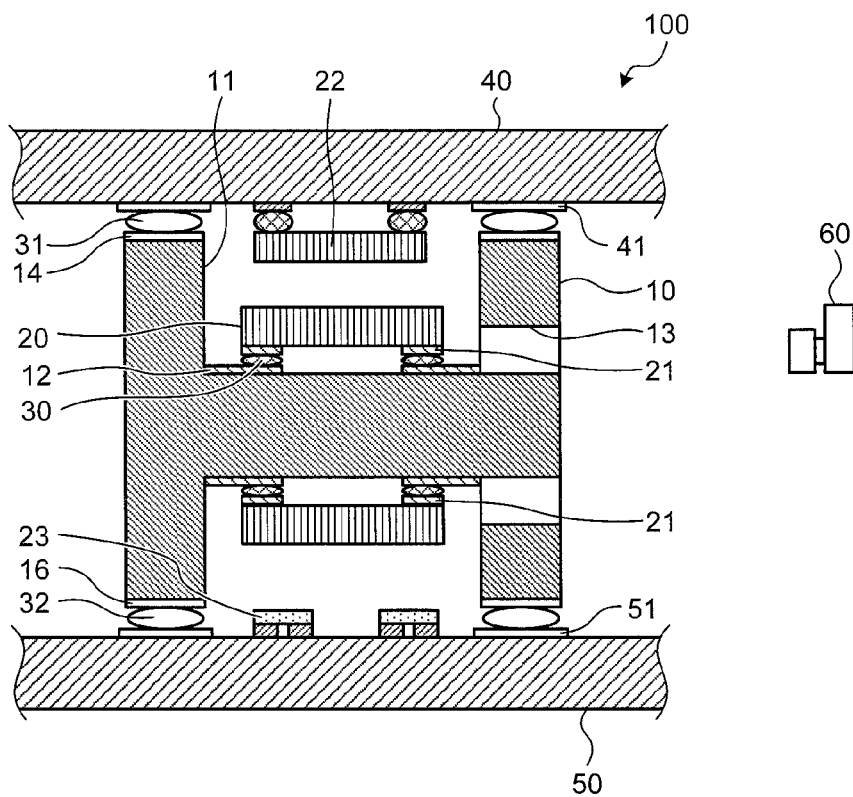


FIG.1C

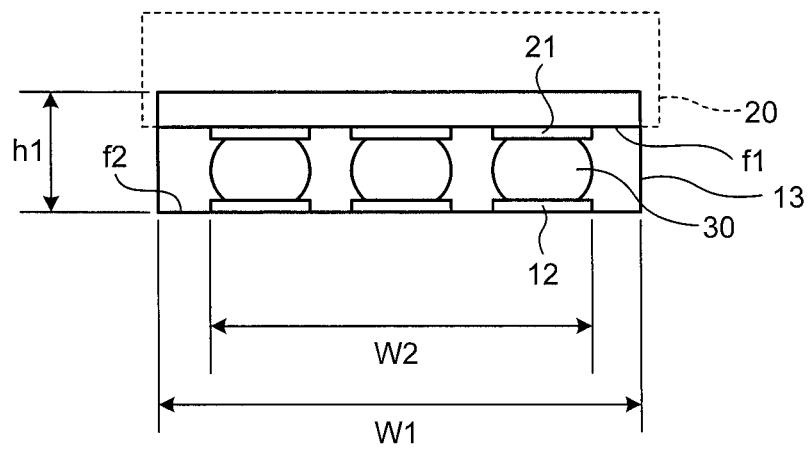


FIG.1D

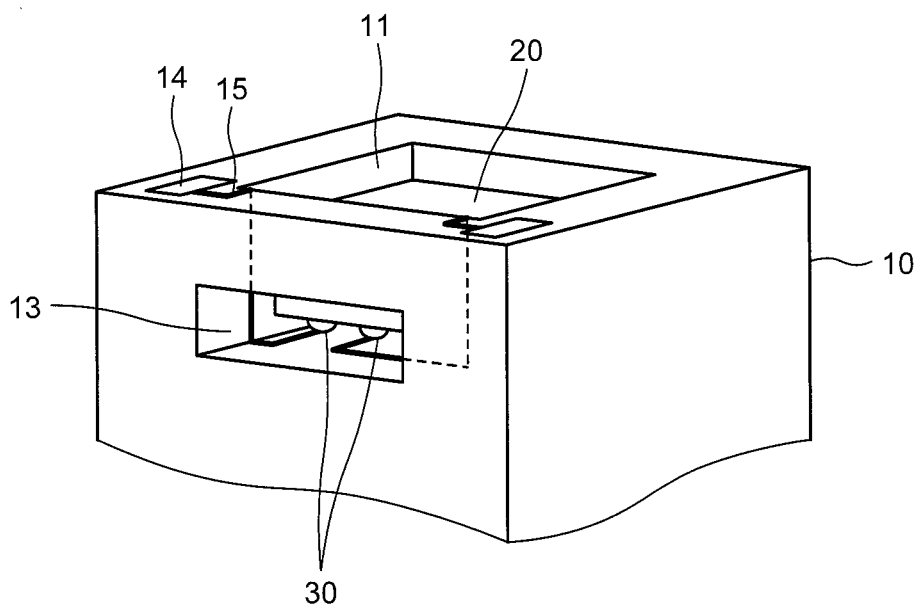


FIG. 1E

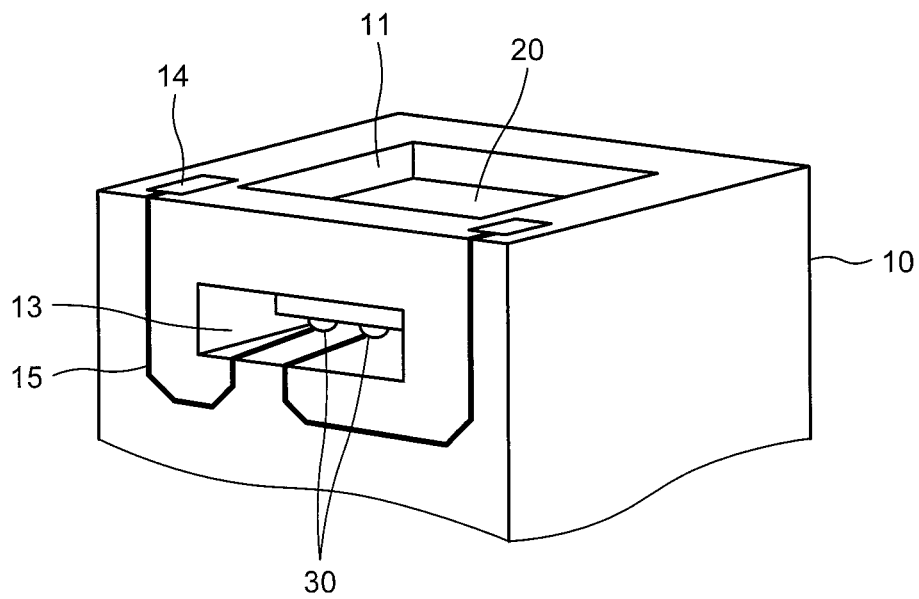


FIG.2A

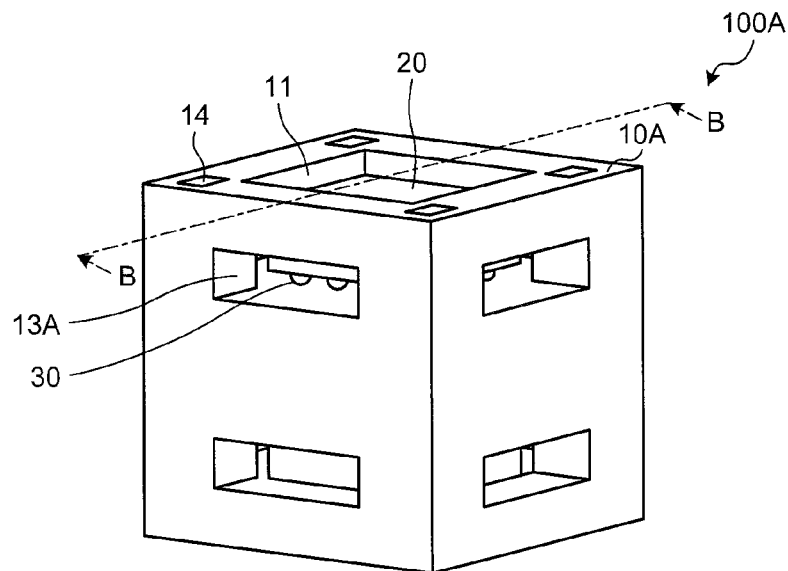


FIG.2B

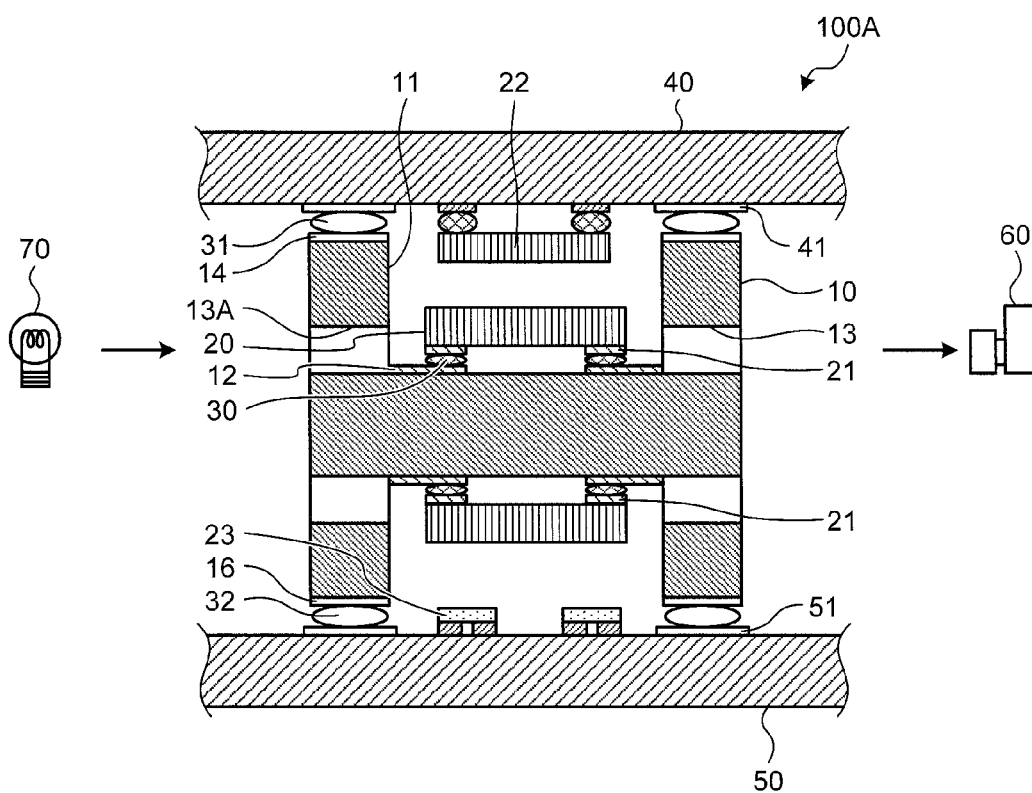


FIG.3A

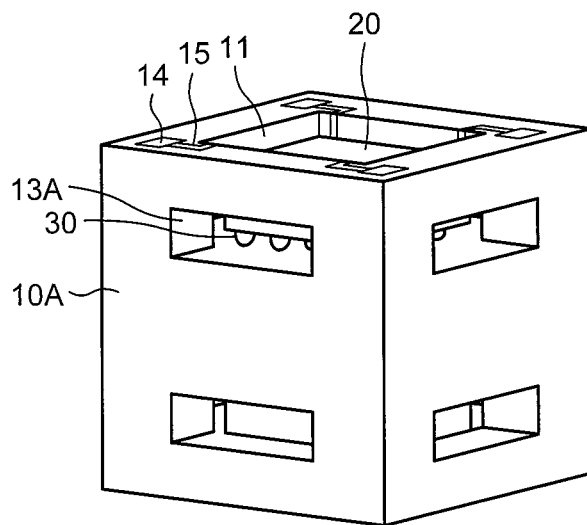


FIG.3B

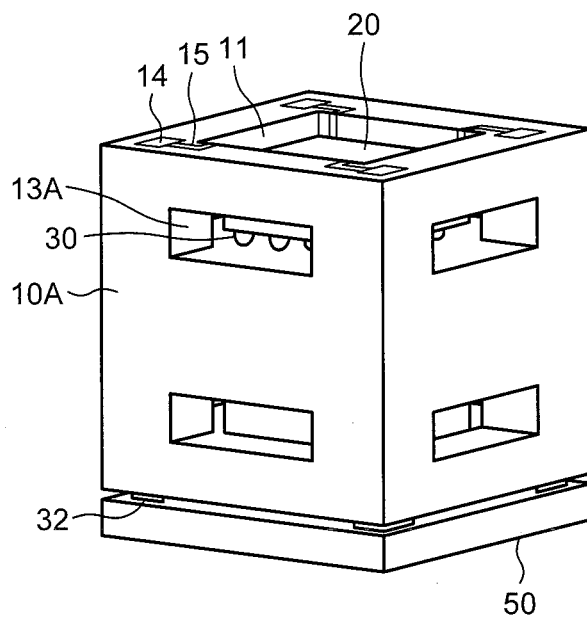


FIG.3C

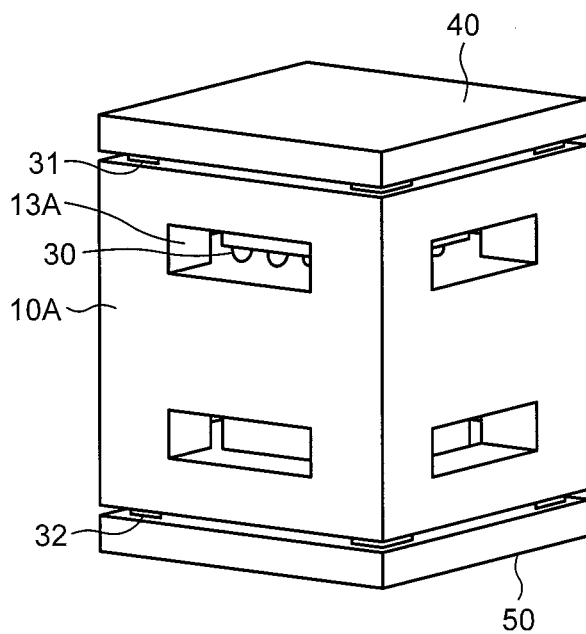


FIG.3D

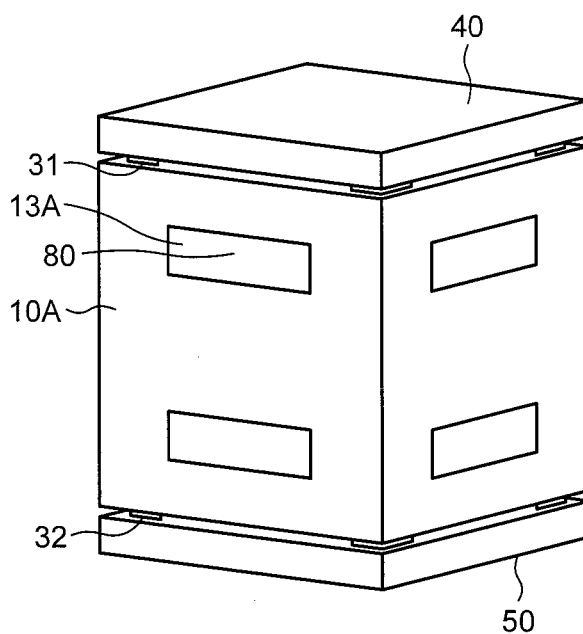


FIG.4

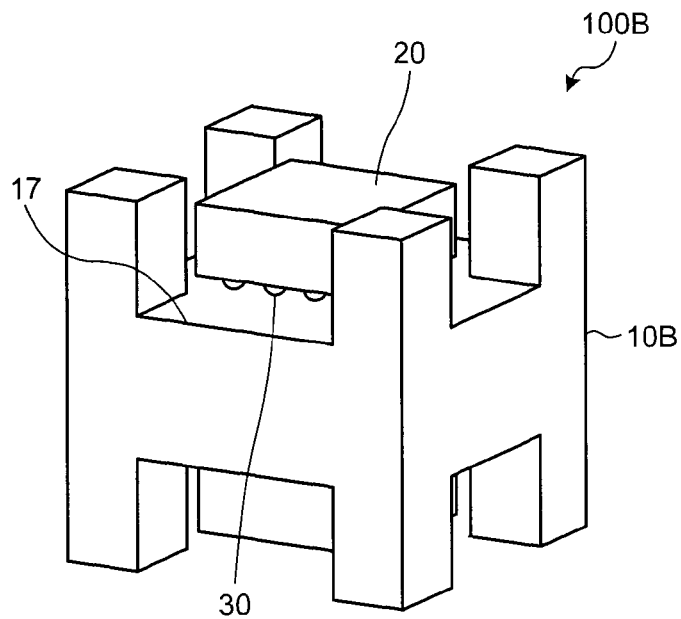


FIG.5

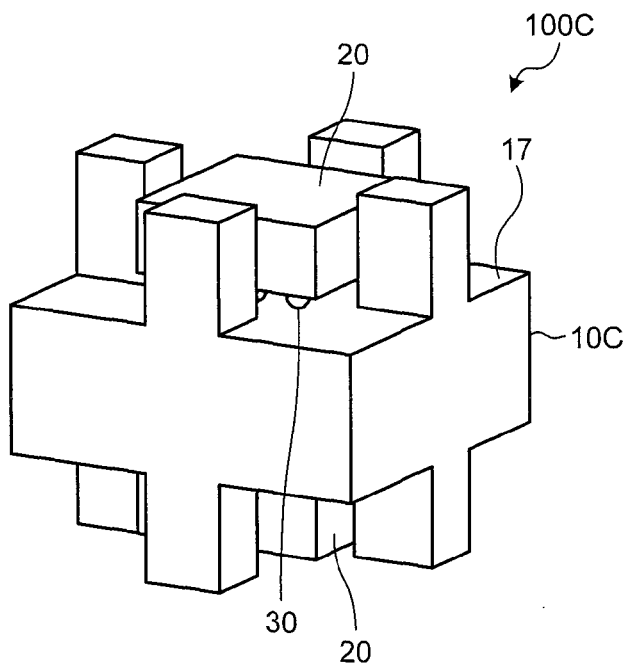


FIG. 6

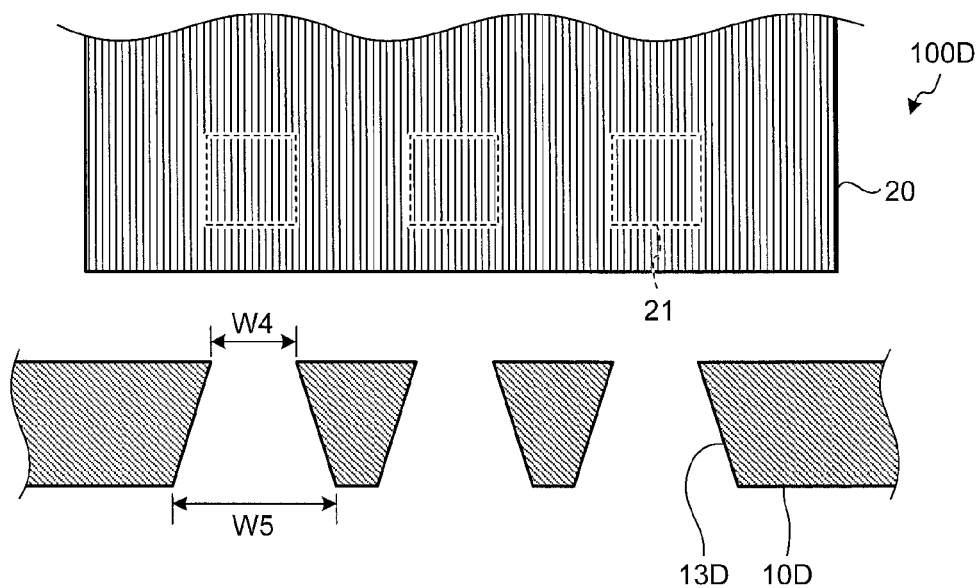
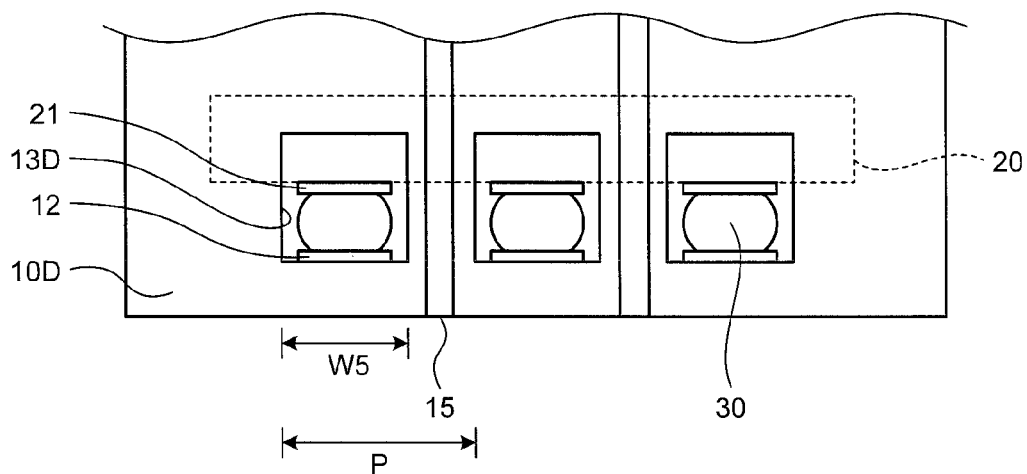


FIG. 7



1

ELECTRONIC COMPONENT MOUNTING STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2013-126921, filed on Jun. 17, 2013, the entire contents of which are incorporated herein by reference.

BACKGROUND

1. Technical Field

The disclosure relates to an electronic component mounting structure.

2. Related Art

In recent years, there has been a great desire for increasing mounting density of the electronic component mounting structure in which an electronic component such as a semiconductor chip is mounted.

As a technique for increasing mounting density of the component, there has been disclosed a three-dimensional electronic circuit substrate in which an electronic component is mounted in a hollow portion provided on a side surface, and a plurality of circuit substrates is connected through a relay substrate on which lead-out wiring is formed on upper and lower surfaces thereof (see JP 4046088 B1, for example).

SUMMARY

In some embodiments, an electronic component mounting structure includes a three-dimensional substrate having a three-dimensional shape and including a hollow portion formed on at least one of side surfaces of the three-dimensional substrate, and an electronic component mounted on a bottom face of the hollow portion. The three-dimensional substrate includes an opening portion on a side surface different from a side surface on which the hollow portion is formed for allowing observation of a connection portion between the bottom face of the hollow portion and the electronic component from an outer periphery side of the three-dimensional substrate.

The above and other features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a perspective view of an electronic component mounting structure according to a first embodiment of the present invention;

FIG. 1B is a sectional view of an electronic circuit apparatus using the electronic component mounting structure in FIG. 1A as a relay substrate (sectional view taken along line A-A of FIG. 1A);

FIG. 1C is an enlarged view around an opening portion of the electronic component mounting structure in FIG. 1A viewed from outside of a three-dimensional substrate;

FIG. 1D is an enlarged view of an upper part of the electronic component mounting structure in FIG. 1A;

FIG. 1E is an enlarged view of an upper part of the electronic component mounting structure according to another example;

2

FIG. 2A is a perspective view of an electronic component mounting structure according to a second embodiment of the present invention;

FIG. 2B is a sectional view of an electronic circuit apparatus using the electronic component mounting structure in FIG. 2A as a relay substrate (sectional view taken along line B-B of FIG. 2A);

FIG. 3A is a view illustrating a method of manufacturing the electronic circuit apparatus in FIG. 2B;

FIG. 3B is a view illustrating the method of manufacturing the electronic circuit apparatus in FIG. 2B;

FIG. 3C is a view illustrating the method of manufacturing the electronic circuit apparatus in FIG. 2B;

FIG. 3D is a view illustrating the method of manufacturing the electronic circuit apparatus in FIG. 2B;

FIG. 4 is a perspective view of an electronic component mounting structure according to a first modification of the second embodiment of the present invention;

FIG. 5 is a perspective view of an electronic component mounting structure according to a second modification of the second embodiment of the present invention;

FIG. 6 is a sectional view of a horizontal plane at a position of an opening portion of an electronic component mounting structure according to a third embodiment of the present invention; and

FIG. 7 is an enlarged view around the opening portion in FIG. 6 viewed from outside of a three-dimensional substrate.

DETAILED DESCRIPTION

Hereinafter, with reference to the attached drawings, modes for carrying out the invention (hereinafter, referred to as “embodiments”) will be described. Note that the embodiments are not intended to limit the present invention. Furthermore, in illustration of the drawings, the same part is denoted with the same reference numeral. Furthermore, the drawings are schematic, whereby it is to be noted that a relationship between thickness and width of each member, a ratio in each member, and the like may be different from reality. Between the drawings, there may be a part in which a relationship and a ratio between dimensions are different.

First Embodiment

FIG. 1A is a perspective view of an electronic component mounting structure **100** according to a first embodiment of the invention. FIG. 1B is a sectional view of an electronic circuit apparatus using the electronic component mounting structure **100** as a relay substrate, and a section taken along line A-A of FIG. 1A is illustrated. FIG. 1C is an enlarged view around an opening portion **13** of the electronic component mounting structure **100** viewed from outside of a three-dimensional substrate. The electronic component mounting structure **100** according to the first embodiment of the present invention is a structure having a three-dimensional substrate **10** on which an electronic component **20** is mounted.

The three-dimensional substrate **10** includes: a hollow portion **11** in which the electronic component **20** is mounted; a connection electrode **12** connected to a connection terminal **21** of the electronic component **20**; the opening portion **13** having a height at which each of a plane including a bottom face **f2** of the hollow portion **11** and a plane including a surface **f1** on which the connection terminal **21** of the electronic component **20** is formed passes through, and having a width, which is not more than a width of the electronic component **20** and not less than a width of the connection terminal **21**; a connection land **14** to be connected to a connection electrode **41** of a circuit substrate **40**; wiring **15** for connecting

3

the connection electrode 12 to the connection land 14; and a connection land 16 to be connected to a connection electrode 51 of a circuit substrate 50.

The hollow portion 11 is provided in at least one of side surfaces forming an external form of the three-dimensional substrate 10. In the first embodiment, the hollow portion 11 is formed on each of upper and lower surfaces of the three-dimensional substrate 10. A base area of the hollow portion 11 may be in a size such that the electronic component 20 can be mounted, and a height of the hollow portion 11 may be in a relationship of: height of the electronic component 20 < height of the hollow portion 11 + height of the connection land 14 + height of a connection member 31 + height of the connection electrode 41. Since the electronic component mounting structure 100 in the first embodiment is connected to the circuit substrate 40 and the circuit substrate 50 at the top and the bottom thereof, in a case where an electronic component 22, an electronic component 23, and the like are mounted on a surface opposing each of the hollow portions 11 of the circuit substrate 40 and the circuit substrate 50, the height of the hollow portion 11 may be in a relationship of: height of the electronic component 20 + height of the electronic component 22 < height of the hollow portion 11 + height of the connection land 14 + height of the connection member 31 + height of the connection electrode 41.

The opening portion 13 is formed in a side surface different from the side surface in which the hollow portion 11 is formed at a position where it is possible to observe a connection portion for connecting the connection terminal 21 and the connection electrode 12, from the outside of the three-dimensional substrate 10. In the first embodiment, the electronic component 20 is mounted on each of the hollow portions 11 provided on the upper and lower surfaces, whereby two opening portions 13 are formed. In the electronic component mounting structure 100 according to the first embodiment, one opening portion 13 is formed for one electronic component 20, and an imaging apparatus 60 for observation is arranged on an extended line of the opening portion 13 and the connection portion for connecting the connection terminal 21 and the connection electrode 12. The imaging apparatus 60 has a ring-shaped lighting around a lens thereof, and radiates light from the ring-shaped lighting toward the connection portion through the opening portion 13, and observes the light reflected by the connection portion. By arranging the opening portion 13 to a position where it is possible to observe the connection portion, in which the connection terminal 21 is connected to the connection electrode 12, from the outside of the three-dimensional substrate 10, a visual test of a connection failure and the like becomes possible. Note that the lighting may also be provided separately from the imaging apparatus 60 (e.g. an external light source to which a light guide is attached).

In the first embodiment, the opening portion 13 enables observation of the connection portion (three in FIG. 1C) in which all of the connection terminals 21 formed on one of the side surfaces of the electronic component 20 are connected to the connection electrodes 12 formed on the bottom face of the hollow portion 11. In order to enable the observation of the connection portion in which all of the connection terminals 21 formed on one of the side surfaces of the electronic component 20 are connected to the connection electrodes 12, a height h1 of the opening portion 13 is the height at which each of the plane including the bottom face f2 of the hollow portion 11 and the plane including the surface f1 on which the connection terminal 21 of the electronic component 20 is formed passes through, or a height at which it is possible to observe the connection electrode 12, a connection member 30, and the

4

connection terminal 21, and a width W1 is equal to or more than a length W2 at which it is possible to observe all of the connection terminals 21 formed on one of the side surfaces of the electronic component 20.

On the upper and lower surfaces of the three-dimensional substrate 10, or the surface on which the hollow portion 11 is formed, the connection land 14 to be connected to the circuit substrate 40 and the connection land 16 to be connected to the circuit substrate 50 are formed. The three-dimensional substrate 10 is connected to the circuit substrate 40 and the circuit substrate 50 by the connection member 31 and a connection member 32 through the connection lands 14 and 16, respectively.

It is preferred that the wiring 15, which connects the connection electrode 12 to the connection land 14 be formed inside the hollow portion 11 as illustrated in FIG. 1D. It is because, in a case where the wiring 15 is formed on surfaces of the opening portion 13 and the three-dimensional substrate 10 as illustrated in FIG. 1E, during observation using the imaging apparatus 60, there is a fear that the observation of the connection portion may be hindered by radiated light being reflected or the like by the wiring 15.

In the electronic component mounting structure 100 according to the first embodiment, it is possible to improve a mounting density by mounting the electronic component 20 on the bottom face of the hollow portion 11. In addition, since the connection portion of the connection terminal 21 of the electronic component 20 and the connection electrode 12 can be observed from the opening portion 13, it is possible to detect a mounting failure of an electronic component.

Second Embodiment

An electronic component mounting structure 100A according to a second embodiment is different from that in the first embodiment in that it has four opening portions 13A for one electronic component 20. FIG. 2A is a perspective view of the electronic component mounting structure 100A according to the second embodiment of the present invention. FIG. 2B is a sectional view of an electronic circuit apparatus using the electronic component mounting structure 100A as a relay substrate, and a section taken along line B-B of FIG. 2A is illustrated.

In the second embodiment, the opening portion 13A is provided on each of four side surfaces of a three-dimensional substrate 10A having a rectangular pillar shape. Similar to the opening portion 13 of the first embodiment, the opening portion 13A is shaped so as to have a height at which each of a plane including a bottom face of a hollow portion 11 and a plane including a surface on which a connection terminal 21 of the electronic component 20 is formed passes through, or a height at which it is possible to observe a connection electrode 12, a connection member 30, and a connection terminal 21, and a width thereof is equal to or more than a length at which it is possible to observe all of the connection terminals 21 formed on one of the side surfaces of the electronic component 20. In the second embodiment, similar to the first embodiment, the electronic component 20 is mounted on each of the hollow portions 11 provided on upper and lower surfaces, whereby two opening portions 13A are formed on each surface, or eight opening portions 13A in total are formed.

In the electronic component mounting structure 100A according to the second embodiment, lighting 70 for irradiating a connection portion between the connection terminal 21 of the electronic component 20 and the connection electrode 12 with light, and an imaging apparatus 60 for observing are arranged on an extended line of the opening portions 13A formed in opposing positions on opposing side surfaces

5

of the three-dimensional substrate **10A**. The light emitted from the lighting **70** is radiated to inside the hollow portion **11** through one of the opening portions **13A**, and the imaging apparatus **60** observes transmitted light, which is radiated from the lighting **70** to the connection portion of the electronic component **20** on a side of the imaging apparatus **60**. To observe the connection portion of the connection terminal **21** on another side surface of the electronic component **20**, arrangements of the lighting **70** and the imaging apparatus **60** may be changed. In the second embodiment, the opening portion **13A** is formed on each of the four side surfaces of the three-dimensional substrate **10A**, whereby it is possible to observe the connection portion of all of the connection terminals **21** formed on the side surfaces of the electronic component **20**. Furthermore, since the opening portion **13A** is formed in an opposing position of the three-dimensional substrate **10A**, it is possible to observe a silhouette of the connection portion by the transmitted light, whereby it becomes easier to detect open caused by insufficiency of the connection member **30**, a short circuit with the adjacent connection terminal **21** caused when the connection member **30** is in a large amount, and the like.

Here, manufacturing of the electronic circuit apparatus using the electronic component mounting structure **100A** in the second embodiment will be described with reference to FIGS. **3A** to **3D**. FIGS. **3A** to **3D** are views illustrating a method of manufacturing the electronic circuit apparatus illustrated in FIG. **2B**.

First, as illustrated in FIG. **3A**, the electronic component mounting structure **100A** is manufactured by installing the electronic component **20** in the hollow portion **11** of the three-dimensional substrate **10A** and by connecting the connection terminal **21** of the electronic component **20** with the connection electrode **12** by the connection member **30**.

Then, as illustrated in FIGS. **2B** and **3B**, a connection land **16** of the three-dimensional substrate **10A** is connected to a connection electrode **51** of a circuit substrate **50** by a connection member **32**, and the three-dimensional substrate **10A** is mounted on the circuit substrate **50**.

Similarly, as illustrated in FIGS. **2B** and **3C**, a connection land **14** of the three-dimensional substrate **10A** is connected to a connection electrode **41** of a circuit substrate **40** by a connection member **31**, and the circuit substrate **40** is mounted on the three-dimensional substrate **10A**.

After the three-dimensional substrate **10A** is connected to the circuit substrate **40** and the circuit substrate **50**, as illustrated in FIG. **3D**, the hollow portion **11** and the opening portion **13A** are filled with a reinforcement member **80** made of resin, and an electronic circuit apparatus is manufactured. The hollow portion **11** may be filled with the reinforcement member **80** therein through the opening portion **13A**. By filling the hollow portion **11** and the opening portion **13A** with the reinforcement member **80**, it is possible to protect the connection portion of the connection terminal **21** and the connection electrode **12** as well as to improve rigidity of the electronic component mounting structure **100A**, whereby it is possible to improve reliability of the product.

As described above, filling of the hollow portion **11** and the opening portion **13A** with the reinforcement member **80** may be performed after connecting with the circuit substrates **40** and **50** or after mounting the electronic component **20** on the three-dimensional substrate **10A** (immediately after FIG. **3A**). However, in a case where the reinforcement member **80** having a heat expansion coefficient largely diverged from a heat expansion coefficient of the three-dimensional substrate **10A** is used, stress is generated due to fluctuation in temperature when connected to the circuit substrates **40** and **50** after-

6

wards. Accordingly, the three-dimensional substrate **10A** is deformed, and a connection failure such as the open and the short circuit may be caused in the connection portion of the circuit substrates **40** and **50** and the three-dimensional substrate **10A**, or reliability of the connection portion may decrease. Therefore, it is preferred that the reinforcement member **80** be filled after the three-dimensional substrate **10A** is connected to the circuit substrates **40** and **50**. Since the electronic component mounting structure **100A** according to the second embodiment is provided with the opening portion **13A**, filling of the reinforcement member **80** may be possible after being connected to the circuit substrates **40** and **50**.

Furthermore, the reinforcement member **80** may fill the entire hollow portion **11** as illustrated in FIG. **3D**, or around the connection portion of the connection terminal **21** of the electronic component **20** and the connection electrode **12**, for example, only a gap between a bottom face of the hollow portion **11** and the electronic component **20**, to a part of the connection terminal **21**, the connection electrode **12**, and the connection member **30** that are visible through the opening portion **13A** such that the reinforcement member **80** does not adhere thereto, while arranging another transparent member to the opening portion **13A**. Accordingly, by filling around the connection portion with the reinforcement member **80**, it is possible to improve connection strength, and by arranging the transparent member to the opening portion **13A**, it is possible to improve rigidity of the three-dimensional substrate **10A** as well as to detect a connection failure by observing the connection portion through the opening portion **13A** in which the transparent member is arranged. Furthermore, it is also possible to select a transparent material as the reinforcement member **80**, protect the connection portion by filling the reinforcement member **80** around the connection portion, and obtain the transparent member by filling it inside the opening portion **13A**.

Note that a cut-out portion **17** may be provided in place of the opening portion **13A** as long as it is possible to observe the connection portion of the connection terminal **21**. By replacing the opening portion **13A** with the cut-out portion **17**, processing of the three-dimensional substrate becomes easier, whereby a cost of the three-dimensional substrate can be suppressed. FIG. **4** is a perspective view of an electronic component mounting structure **100B** according to a first modification of the second embodiment of the present invention.

In the electronic component mounting structure **100B** according to the first modification, a three-dimensional substrate **10B** has a cut-out portion **17** on each of side surfaces thereof from an upper surface or a lower surface thereof to a bottom face of the hollow portion **11**. A width of the cut-out portion **17** may not be less than a length at which the connection portion of the connection terminal **21** to be observed can be observed, and the width of the cut-out portion **17** according to the first modification is a length at which all of the connection terminals **21** formed on one of the side surfaces of the electronic component **20** can be observed.

In the first modification of the second embodiment, the cut-out portion **17** is formed on four of the side surfaces of the three-dimensional substrate **10B** such that all of the connection portions of the connection terminals **21** formed on the side surfaces of the electronic component **20** can be observed. Furthermore, similar to the opening portion **13A**, since the cut-out portion **17** is formed in an opposing position of the three-dimensional substrate **10B**, it is possible to observe a silhouette of the connection portion by the transmitted light.

Furthermore, the cut-out portion **17** may be provided to a corner portion of the three-dimensional substrate. FIG. **5** is a

perspective view of an electronic component mounting structure **100C** according to a second modification of the second embodiment of the present invention.

Although it is more effective to observe all of the connection portions of the connection terminal **21** formed around the electronic component **20** in order to detect a mounting failure, a connection state of the connection terminal **21**, which is formed at four corners of the electronic component **20**, has the most influence on the connection strength. Therefore, it is also possible to observe the connection portion of the connection terminal **21**, which is formed at the four corners of the electronic component **20**, by providing the cut-out portion **17** to the corner portion of a three-dimensional substrate **10C**. By providing the cut-out portion **17** to the corner portion of the three-dimensional substrate, it is possible to increase an amount of the reinforcement member **80** arranged around the four corners of the electronic component **20** where structurally the most load is applied, whereby reliability of the electronic component mounting structure can be improved.

Third Embodiment

An electronic component mounting structure **100D** according to a third embodiment is different from that according to the first and second embodiments in that an opening portion **13D** is formed for each of connection terminals **21** formed around an electronic component **20**. FIG. 6 is a sectional view of a horizontal plane in a position of the opening portion **13D** of an electronic component mounting structure **100D** according to the third embodiment of the present invention. FIG. 7 is an enlarged view around the opening portion of the electronic component mounting structure **100D** in FIG. 6 viewed from outside of a three-dimensional substrate **10D**.

The opening portion **13D** formed for each of the connection terminals **21** is arranged at a position where a connection portion of the connection terminal **21** and a connection electrode **12** can be observed from the outside of the three-dimensional substrate **10D**. A height of the opening portion **13D**, similar to the opening portions **13** and **13A** of the first and second embodiments, is to be a height at which each of a plane including a bottom face of a hollow portion **11** and a plane including a surface on which the connection terminal **21** of the electronic component **20** is formed passes through, or a height at which it is possible to observe the connection electrode **12**, a connection member **30**, and the connection terminal **21**.

The three-dimensional substrate **10D** according to the third embodiment has a fine structure (hollow portion **11**, opening portion **13D**, and the like), whereby it is preferred that it be manufactured by injection molding of resin. Molding becomes easy when the opening portion **13D** has a mortar shape. In a case where light is radiated from outside of the three-dimensional substrate **10D**, and the light reflected by the connection portion is observed, as illustrated in FIG. 6, it is preferred that the opening portion **13D** have a mortar shape in which an opening area increases from a side of the hollow portion **11** toward an outer surface of the three-dimensional substrate **10D**. A width **W4** on the side of the hollow portion **11** of the opening portion **13D** is not less than a width of the connection terminal **21** of the electronic component **20**, and a width **W5** on an outer surface side is smaller than a pitch **P** between the adjacent connection terminals **21**. With the width **W4** not less than a width of the connection terminal **21**, observation of the connection portion becomes possible, and with the width **W5** smaller than the pitch **P** between the adjacent connection terminals **21**, wiring **15** can be formed on a wall between the opening portions **13D**, thereby improving a degree of freedom in design. In FIG. 7, the wiring **15** is

formed outside of the three-dimensional substrate **10D**; however, it is also possible to form the wiring **15** inside the hollow portion **11**.

In the electronic component mounting structure **100D** according to the third embodiment, similar to the first and second embodiments, it is possible to improve mounting density by mounting the electronic component **20** inside the hollow portion **11**, and to observe the connection portion of the connection terminal **21** of the electronic component **20** and the connection electrode **12** through the opening portion **13D**, whereby it is possible to detect mounting failure of the electronic component. Furthermore, since the opening portion **13D** is provided per connection terminal **21**, it is possible to form a wiring **15** on a wall of the opening portion **13D**, whereby the degree of freedom in designing can be improved. (Note 1)

A method of manufacturing an electronic component mounting structure in which an electronic component is mounted on a three-dimensional substrate, the method including:

a connecting step of mounting the electronic component in a hollow portion provided on at least one of side surfaces forming an external form of the three-dimensional substrate to connect a connection electrode to a connection terminal of the electronic component;

a testing step of observing a connection portion between a bottom face of the hollow portion and the electronic component from an outer periphery side of the three-dimensional substrate, through an opening portion formed on a side surface different from a side surface on which the hollow portion of the three-dimensional substrate is formed; and

a filling step of filling the connection portion between the connection terminal and the connection electrode with a reinforcement member through the opening portion.

(Note 2)

A method of manufacturing an electronic circuit apparatus in which an electronic component mounting structure and at least one or more circuit substrates are connected to each other, the method including:

a mounting step of mounting an electronic component in a hollow portion provided on at least one of side surfaces forming an external form of a three-dimensional substrate, and connecting a connection electrode to a connection terminal of the electronic component to manufacture the electronic component mounting structure;

a testing step of observing a connection portion between a bottom face of the hollow portion and the electronic component from an outer periphery side of the three-dimensional substrate, through an opening portion formed on a side surface different from a side surface on which the hollow portion of the three-dimensional substrate is formed;

a connecting step of connecting the electronic component mounting structure to the at least one or more circuit substrates; and

a filling step of filling the connection portion between the connection terminal and the connection electrode with a reinforcement member through the opening portion.

As described above, the electronic component mounting structure according to some embodiments is useful in a field in which improvement of mounting density of the electronic component is demanded.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without

departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

What is claimed is:

1. An electronic component mounting structure, comprising: a three-dimensional substrate having a three dimensional shape and including a hollow portion formed on at least one of side surfaces of the three dimensional substrate the three-dimensional substrate including: a bottom face, and four wall portions forming the hollow portion, each perpendicularly connected to the bottom face; and an electronic component mounted on the bottom face of the hollow portion, wherein in at least one of the four wall portions, the three dimensional substrate includes an opening portion is formed on a side surface different from a side surface on which the hollow portion is formed for allowing observation of a connection portion between the bottom face of the hollow portion and the electronic component from an outer periphery side of the three-dimensional substrate, wherein the three-dimensional substrate includes a connection electrode on the bottom face of the hollow portion, the electronic component includes a connection terminal connected to the connection electrode, and the opening portion has a height at which each of a plane including the bottom face of the hollow portion and a plane including a surface of the electronic component opposed to the three-dimensional substrate passes through, and has a width not more than a width of the electronic component and not less than a width of the connection terminal.

2. The electronic component mounting structure according to claim 1, wherein

the three-dimensional substrate further includes additional one or more opening portions, wherein each of the opening portion and the additional one or more opening portions is formed at a position opposed to any of the other opening portions.

3. The electronic component mounting structure according to claim 1, wherein the opening portion has a mortar shape in which an opening area increases from a side of the hollow portion toward an outer surface of the three-dimensional substrate.

4. The electronic component mounting structure according to claim 1, wherein

the three-dimensional substrate further includes: a connection land provided on a side surface on which the hollow portion is formed, the connection land being connected to a circuit substrate; and wiring for connecting the connection electrode to the connection land, wherein the wiring is disposed inside the hollow portion.

5. The electronic component mounting structure according to claim 1, wherein

the three-dimensional substrate further includes additional one or more opening portions, and the electronic component further includes additional one or more connection terminals,

the opening portion and the additional one or more opening portions are provided for each of the connection terminal and the additional one or more connection terminals to be observed, and

a width of each of the opening portion and the additional one or more opening portions is smaller than a pitch between adjacent connection terminals.

6. The electronic component mounting structure according to claim 1, further comprising a transparent member arranged in the opening portion.

7. The electronic component mounting structure according to claim 1, further comprising an electrode on one or more end faces of the four wall portions for connecting the electrode to a circuit substrate.

8. The electronic component mounting structure according to claim 1, wherein;

the four wall portions are perpendicularly connected to a first side of the bottom face;

the connection portion is a first connection portion and the electronic component is a first electronic component mounted on the first side of the bottom face; and

the three-dimensional substrate further comprising four additional walls perpendicularly connected to a second side of the bottom face;

wherein an additional opening portion is formed in at least one of the four additional wall portions for allowing observation of a second connection portion between the second side of the bottom face and a second electronic component mounted on the second side of the bottom face from an outer periphery side of the three-dimensional substrate.

9. A substrate comprising: a three-dimensional substrate body having a hollow portion, the three-dimensional substrate body including: a bottom face; and four wall portions forming the hollow portion, each perpendicularly connected to the bottom face; wherein an opening portion is formed in at least one of the four wall portions for allowing observation of a connection portion between the bottom face of the hollow portion and an electronic component mounted on the bottom face from an outer periphery side of the three-dimensional substrate body, wherein the three-dimensional substrate body includes a connection electrode on the bottom face of the hollow portion, and the opening portion has a height at which each of a plane including the bottom face of the hollow portion and a plane including a surface of the electronic component opposed to the three-dimensional substrate body passes through, and has a width not more than a width of the electronic component and not less than a width of a connection terminal of the electronic component connected to the connection electrode.

10. The substrate according to claim 9, wherein the three-dimensional substrate body further includes additional one or more opening portions, wherein each of the opening portion and the additional one or more opening portions is formed at a position opposed to any of the other opening portions.

11. The substrate according to claim 9, wherein the opening portion has a mortar shape in which an opening area increases from a side of the hollow portion toward an outer surface of the three-dimensional substrate body.

12. The substrate according to claim 9, wherein the three-dimensional substrate body further includes: a connection land provided on a side surface on which the hollow portion is formed, the connection land being connected to a circuit substrate; and wiring for connecting the connection electrode to the connection land, wherein

the wiring is disposed inside the hollow portion.

13. The substrate according to claim 9, wherein the three-dimensional substrate body further includes additional one or more opening portions corresponding to additional one or more connection terminals of the electronic component,

the opening portion and the additional one or more opening portions are provided for each of the connection terminal and the additional one or more connection terminals to be observed, and

11

a width of each of the opening portion and the additional one or more opening portions is smaller than a pitch between adjacent connection terminals.

14. The substrate according to claim 9, further comprising a transparent member arranged in the opening portion. 5

15. The substrate according to claim 9, further comprising an electrode on one or more end faces of the four wall portions for connecting the electrode to a circuit substrate.

16. The substrate according to claim 9, wherein; the four wall portions are perpendicularly connected to a first side of the bottom face; 10

the connection portion is a first connection portion and the electronic component is a first electronic component mounted on the first side of the bottom face; and

the three-dimensional substrate body further comprising four additional walls perpendicularly connected to a second side of the bottom face; 15

wherein an additional opening portion is formed in at least one of the four additional wall portions for allowing observation of a second connection portion between the second side of the bottom face and a second electronic component mounted on the second side of the bottom face from an outer periphery side of the three-dimensional substrate body. 20

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